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(54) **DETECTOR LOGIC AND RADIO IDENTIFICATION DEVICE AND METHOD FOR ENHANCING TERMINAL OPERATIONS**

DETEKTORLOGIK UND FUNKIDENTIFIKATIONSEINRICHTUNG UND VERFAHREN ZUR VERBESSERUNG DES TERMINAL-BETRIEBS

DISPOSITIF D'IDENTIFICATION LOGIQUE DETECTEUR ET RADIO ET PROCEDE D'AMELIORATION DU FONCTIONNEMENT DU TERMINAL

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Description

[0001] The present invention relates to short-range communication systems, more particularly to improvements in RF-tagging communication systems, wherein the present invention provides means in a portable consumer electronic device to indirectly and internally utilize radio frequency identification (RFID) information stored in connection within the radio frequency identification (RFID) module to enhance and direct subsequent terminal operation.

[0002] Radio frequency identification (RFID) technology relates basically to the field of local communication technology and more particularly local communication technology involving electromagnetic and/or electrostatic coupling technology. Electromagnetic and/or electrostatic coupling is implemented in the radio frequency (RF) portion of the electromagnetic spectrum, using for example radio frequency identification (RFID) technology, which primarily includes radio frequency identification (RFID) transponders also denoted as radio frequency identification (RFID) tags and reader devices for radio frequency transponders also denoted for simplicity as radio frequency identification (RFID) readers.

[0003] Originally, radio frequency identification (RFID) technology has been developed and introduced for electronic article surveillance, article management purposes and logistics primarily for replacing bar code identification labels which are used for article management purposes and logistics up to now. A typical implementation of a state of the art radio frequency identification (RFID) transponder is shown with respect to Fig. 1. A typical radio frequency identification (RFID) transponder module 10 includes conventionally an electronic circuit, depicted exemplary as transponder logic 11, with data storage capacity, depicted herein as transponder memory 12, and a radio frequency (RF) interface 235 and high frequency (HF) interface, respectively, which couples an antenna 13 to the transponder logic 11. The radio frequency identification (RFID) transponders are typically accommodated in small containers. Depending on the requirements made on envisaged applications of the radio frequency identification (RFID) transponders (i.e. the data transmission rate, energy of the interrogation, transmission range etc.) different types are provided for data/information transmission at different radio frequencies within a range from several 10-100 kHz to some GHz (e.g. 134 kHz, 13,56 MHz, 860 - 928 MHz etc; only for illustration). Two main classes of radio frequency identification (RFID) transponders can be distinguished. Passive radio frequency identification (RFID) transponders are activated and energized by radio frequency identification (RFID) readers, which generate an interrogation signal, for example a radio frequency (RF) signal at a certain frequency. Active radio frequency identification (RFID) transponders comprise own power supplies such as batteries or accumulators for energizing.

[0004] On activation of a radio frequency identification

(RFID) transponder by a radio frequency identification (RFID) reader, the informational contents stored in the transponder memory 12 are modulated onto a radio frequency (RF) signal, which is emitted by the antenna 13 of the radio frequency identification (RFID) transponder to be detected and received by the radio frequency identification (RFID) reader. Typical state of the art radio frequency identification (RFID) transponders correspond to radio frequency identification (RFID) standards such as

- 5 the ISO 14443 type A standard or the Mifare standard. In accordance with the applicational purpose of a radio frequency identification (RFID) transponder, the information or data stored in the transponder memory may be either hard-coded or soft-coded. Hard-coded means that
- 15 the information or data stored in the transponder memory 13 is predetermined and unmodifiable. Soft-coded means that the information or data stored in the transponder memory 13 is configurable by an external entity. The configuration of the transponder memory may be
- 20 performed by a radio frequency (RF) signal via the antenna 13 or may be performed via a configuration interface, which allows for connection with the transponder memory 13.

[0005] More particularly, in the case of a passive radio frequency identification (RFID) transponder (i.e., having no local power source), the radio frequency identification (RFID) transponder is conventionally energized by a time-varying electromagnetic radio frequency (RF) signal/wave generated by the interrogating radio frequency identification (RFID) reader. When the radio frequency (RF) field passes through the antenna coil associated with the radio frequency identification (RFID) transponder, a voltage is generated across the coil. This voltage is ultimately used to energize the radio frequency identification (RFID) transponder, and enables back transmission of information from the radio frequency identification (RFID) transponder to the radio frequency identification (RFID) reader, which is sometimes referred to as back-scattering.

[0006] Interest in various radio frequency (RF) tagging technologies has recently grown significantly resulting to development of various radio frequency (RF) tagging applications outside the conventional manufacturing line and electronic article surveillance applications.

[0007] As RF-tagging technologies are considered to become as one technology providing short-range interaction applications in the near future, especially in mobile communication environment, the basic nature of the RF-tagging technologies (passive communication, no means for "true" duplex data transfer) is becoming more of an issue to be considered in connection with applications relating to interactivity.

[0008] As soon as a portable device equipped with a radio frequency identification (RFID) transponder logic receives an interrogation signal upon entering into a coverage area of radio frequency identification (RFID) reader device, the radio frequency identification (RFID) transponder responds to the interrogation signal by back-

transmitting of radio frequency (RF) signals embedding data stored in connection with the radio frequency identification (RFID) transponder. The radio frequency identification (RFID) reader device may be capable of initiating or providing various services or applications based on the data received from the radio frequency identification (RFID) transponder. However, the portable device equipped with a conventional radio frequency identification (RFID) transponder circuit does not have any means to determine whether the data of the radio frequency identification (RFID) transponder have been read by the external radio frequency identification (RFID) reader device for performing subsequent operations based on this determination.

[0009] Moreover, when considering various transaction applications (such as ticketing services) security and privacy issues relating especially to ticket redemption process needs to be taken into account. For instance a user may have purchased a mass transit ticket valid for a certain time-period or a serial ticket with multiple one-way- or roundtrips. When such a ticket is implemented by way of a radio frequency identification (RFID) transponder providing the ticket information, the information typically includes some private user-related information (e.g. social-security number, date of birth, customer identification or like) and/or other confidential and secure information (e.g. ticket identifier or like). Such sensitive information is preferably kept secret in order to prevent possible misuse. In order to keep such sensitive information hidden (invisible) to any potentially hostile radio frequency identification (RFID) reader devices, it would be advantageous if the mobile terminal equipped with the radio frequency identification (RFID) transponder circuit, which is capable to determine whether the data sorted in the radio frequency identification (RFID) transponder has been read-out in order to remove the sensitive data from the radio frequency identification (RFID) transponder to enhance security. In document WO 03/081519, an RFID transponder is described which is capable of emitting a wireless signal representing information provided by an electronic apparatus to an interrogator. The transmission may be authorized by a user via user input codes in response to an interrogation signal. The preamble of claim 1 is based on this disclosure.

[0010] Accordingly, the object of the present invention is to provide an implementation and a method, on the basis of which a detection of a read access to a radio frequency identification (RFID) transponder by a corresponding reader device is detectable and analyzable.

[0011] In particular, the present invention is directed to provide back-end logic for allowing the radio frequency identification (RFID) transponder circuit to provide information relating to a reading process of the transponder information stored in the radio frequency identification (RFID) transponder.

[0012] More particularly, the present invention is further directed to allow a portable device equipped with a radio frequency identification (RFID) transponder circuit

and having a detector logic for performing subsequent operations based on a detection determination. The subsequent operations may comprise for instance the operation or initiation of a particular predefined service(s) and application(s) corresponding to the read radio frequency identification (RFID) transponder data, respectively.

[0013] Advantageously, the present invention provides means and methods for enhancing interaction and services by means of providing internal input within a terminal device to initiate processes relating to certain services and applications. Moreover, the present invention provides beneficially means and methods for enhancing security and privacy issues in relation to transaction service especially in connection with ticketing applications.

[0014] According to various aspects of the invention, a radio frequency identification device as claimed in appended claim 1 and a method as claimed in claim 7 are provided, with embodiments and modifications of these being claimed in the dependent claims.

[0015] In the following, the present invention will be described in greater detail with reference to embodiments and the accompanying drawings, in which

- 25 Fig. 1 shows schematically a typical internal structure of a state of the art RFID transponder;
- Fig. 2a shows schematically an implementation of a conventional electronic microprocessor-based device, which includes additionally a
- 30 RFID transponder and a detector logic according to an embodiment of the present invention;
- Fig. 2b shows schematically an implementation of a RFID transponder with a detector logic according to an embodiment of the present invention;
- 35 Fig. 2c shows schematically an implementation of an improved RFID module with a detector logic according to an embodiment of the present invention;
- 40 Fig. 3a shows schematically a flow chart comprising a first operational sequence according to an embodiment of the present invention; and
- Fig. 3b shows schematically a flow chart comprising a second operational sequence according to
- 45 an embodiment of the present invention.

[0016] Throughout the detailed description and the accompanying drawings same or similar components, units or devices will be referenced by same reference numerals for clarity purposes.

[0017] In principle, the below description referring to embodiments of the present invention will illustrate different implementational concepts for realizing and/or implementing detection functionality to RFID transponders. **55** More detailed, the illustrated embodiments of the present invention purposes to implement back-end logic units serving for the detection functionality. In particular, in a first embodiment a detector logic is provided for being

implemented supplementary to a RFID transponder, in a second embodiment a detector logic is provided to be integrated into a RFID transponder and in a third embodiment a detector logic is provided to be integrated into a RFID module supporting RFID transponder functionality and RFID reader functionality.

[0018] It shall be noted that the described embodiments serve as examples to illustrate the inventive concept, on the basis of which the detection functionality will be described in detail. Those skilled in the art will immediately appreciate on the basis of the description below that the inventive concept is applicable to similar and related short-range communication technologies being based on electromagnetic and/or electrostatic coupling.

[0019] Fig. 2a illustrates schematically an implementation of a portable consumer electronic (CE) device being equipped with a RFID transponder and a detector logic according to an embodiment of the present invention.

[0020] The block diagram of Fig. 2a illustrates a principle structure design of a cellular terminal, which should exemplary represent any kind of portable CE device 100 in the sense of the present invention. It shall be understood that the present invention is not limited to any specific kind of portable CE device. The illustrated cellular terminal comprises typically a central processing unit (CPU) 110, a data storage 120, an application storage 130, input/output means including audio input/output (I/O) means 150, a keypad with input controller (Ctrl) 160 and a display with display controller (Ctrl) 170. A cellular interface (I/F) 180 coupled to a cellular antenna provides for an over-the-air interface, which serves in conjunction with a subscriber identification module (SIM) 140 for cellular communications with a corresponding radio access network (RAN) of a public land mobile network (PLMN).

[0021] A short-range interface (I/F) 190 or short-range transceiver may be additionally implemented in portable CE device 100 to provide for local data communication with a corresponding counterpart network, base station or transceiver. In general, the short-range interface (I/F) 190 can be realized by a low-power radio frequency transceiver such as a Bluetooth transceiver, a WLAN (wireless local area network) transceiver, a ultra-wide band transceiver or any other transceiver operable with a IEEE 802.xx standard. Moreover, the short-range interface (I/F) 190 can be also implemented as a infrared-based interface such as a IrDA (infrared direct access) interface or an interface being based on radio frequency identification (RFID) technology, namely RFID reader, RFID transponder and near field communication standard, respectively.

[0022] The cellular interface (I/F) 180 is arranged as a cellular transceiver to receive signals from the cellular antenna, decodes the signals, demodulates them and also reduces them to the base band frequency. The output of the cellular interface (I/F) 180 thus consists of a stream of data that may require further processing by the central processing unit (CPU) 110. The cellular interface

(I/F) 180 arranged as a cellular transceiver also receives data from the central processing unit (CPU) 110, which are to be transmitted via the over-the-air interface to the radio access network (RAN). Therefore, the cellular interface (I/F) 180 encodes, modulates and up converts the signal to the radio frequency, which is to be used. The cellular antenna then transmits the resulting radio frequency signal to the corresponding radio access network (RAN) of the public land mobile network (PLMN).

[0023] The display and display controller (Ctrl) 170 are controlled by the central processing unit (CPU) 110 and provides information for the user typically by the means of a user interface. The keypad and keypad controller (Ctrl) 160 are provided to allow the user to input information. The information input via the keypad is supplied to the central processing unit (CPU) 110, which may be controlled in accordance with the input information. The audio input/output (I/O) means 150 includes at least a speaker for reproducing an audio signal and a microphone for recording an audio signal. The central processing unit (CPU) 110 may control the conversion of audio data to audio output signals and the conversion of audio input signals into audio data, where the audio data have a suitable format for cellular transmission.

[0024] The RFID transponder module 200 is operable with the aforementioned portable CE device 100 embodied as cellular phone for the way of illustration. In principle, the illustrated RFID transponder module 200 includes a transponder logic, which servers for the operation of the RFID transponder module 200, a transponder memory for storing data and information for being communicated via the RFID transponder module 200 and an antenna of the RAID transponder module. The detailed set-up and the operation may correspond to the set-up and the operation of a conventional passive RFID transponder. That means that the transponder logic is connected to the antenna via a radio frequency (RF) interface and a high frequency (HF) interface, respectively and the antenna is adapted to the predetermined radio frequency frequencies deployed for operating. On reception of an interrogation signal by the antenna, the RFID transponder module 200 is energized and emits a respond signal, which codes the data stored in the transponder memory. The interrogation signal is conventionally emitted by a correspondingly adapted RFID reader, which emits the interrogation signal is set the RFID transponder module 200 into operation in order to consequently receive the response signal, which emission is effected by the energizing of the RFID transponder module 200.

[0025] Additionally, the illustrative portable CE device 100 comprises a detector logic 240. The detector logic 240 is responsible to detect the operation of the RFID transponder module 200. That means the detector logic 240 provides a signal on detection of the operation of the RFID transponder module 200 to be supplied to the logic of the portable CE device 100, in particular to the central processing unit (CPU) 110 for being further processed.

[0026] To allow the detection operation, the detector

logic 240 can be coupled to the RFID transponder module 200 for sensing the operational state thereof. Correspondingly, the detector logic 240 should be able to at least sense the reception of an interrogating signal received via the antenna of the RAID transponder module 200 or the energizing of the transponder logic effected by the electromagnetic coupling-in of an interrogating signal.

[0027] Alternatively, the detector logic 240 can also be provided with a detector antenna and detector radio frequency (RF) interface connected to the detector antenna. In case the detector antenna is adapted to the operation frequency/frequencies of the RFID transponder module 200, an interrogating signal dedicated to activate the RFID transponder module 200 couples likewise into the detector antenna, which is detectable via the detector radio frequency (RF) interface. Hereby, the detector logic 240 is also capable to supply a detection signal to the portable CE device 100 and to the central processing unit (CPU) 110, respectively, to allow for further processing.

[0028] More detailed embodiments of the detector logic 240 and more detailed detection signal processing will be discussed with reference to the following figures.

[0029] Fig. 2b illustrates schematically an implementation of a RFID transponder module with detector logic according to an embodiment of the present invention. The RFID transponder module of Fig. 2b is adapted to be connectable with any kind of portable CE device; particularly, a portable CE device 100 as described above. The illustrated RFID transponder module may be embodied with a configurable transponder memory 220.

[0030] In detail, the illustrated RFID transponder module includes a transponder logic 210, which serves for the operation of the RFID transponder module, a transponder memory 220 for storing data and information for being communicated via the RFID transponder module and an antenna 230. The transponder logic 210 is connected to the antenna 230 via a radio frequency (RF) interface 235 and a high frequency (HF) interface, respectively (not shown) and the antenna 230 is adapted to the predetermined radio frequency (RF) deployed for operating.

[0031] The radio frequency (RF) interface 235 and antenna 230 are adequately adapted to receive one or more interrogation signals and to transmit one or more response signals carrying information retrieved from the transponder memory 220.

[0032] The antenna 230 is connected to the radio frequency (RF) interface 235, which supplies RF/HF signals generated by the radio frequency (RF) interface 235 to the antenna 230 and which accepts RF/HF signals received by the antenna 230. The radio frequency (RF) interface 235 is responsible for both modulating and demodulating of the signals to be transmitted and received by the antenna 230, respectively.

[0033] The radio frequency (RF) interface 235 is typically capable to transmit demodulated signals to the

transponder logic 210 and to receive signals from the transponder logic 210 to be modulated and transmitted. More particularly, the radio frequency (RF) interface 235 provides further signals necessary for the operation of

5 the transponder logic 210, which are in detail a power supply signal (voltage signal) and a clock signal. The power supply signal is obtained from the coupling of the interrogating electromagnetic field into the antenna 230, whereas the clock signal is obtained from the demodulator comprised in the radio frequency (RF) interface 235. The power supply signal and the clock signal are obligate for operating the transponder logic 210, which is energized by interrogating signal emitted by an external interrogating entity, preferably, a RFID reader.

10 **[0034]** The transponder logic 210 is coupled to an interface, herein data interface (I/F) 215, which is coupled via connection 300 to allow reception of data from the portable CE device 100 having the corresponding data interface (I/F). The data received from the portable CE 20 device 100 serve to configure the transponder memory 220. The data interface (I/F) 215 interfacing between reader logic 210 and the embodied cellular phone may be established by appropriate hardware and/or software interfaces. Additionally, the data interface (I/F) 215 may 25 integrate a power interface, which is supplied with power by the coupled portable CE device 100 and energizes the RFID transponder as long as the portable CE device 100 provides power supply.

[0035] The transponder memory 220 stores the data 30 and information, respectively, which is retrievable by a corresponding RFID reader. Accordingly, the transponder memory 220 is connected to transponder logic 210 and the transponder memory 220 is implemented as a configurable memory. Various storage technologies are 35 available to implement a configurable memory and in particular non-volatile configurable storage technologies are applicable therefor. The configurable transponder memory 220 is under control of the transponder logic 210. Therefore, the transponder logic 210 is coupled via data 40 interface (I/F) 215 to the data interface (I/F) of the portable CE device 100. Data received by the transponder logic via data interface (I/F) are supplied to the transponder memory 220 to be stored therein.

[0036] The RFID transponder module illustrated in Fig. 45 2b may be attached to or embedded in any portable CE device embodied herein as a cellular phone for the way of illustration. The RFID transponder module may be provided with a data interface (I/F) 215 such as a serial interface, a proprietary interface or any kind of known data 50 interface, which is adapted to interface between the RFID transponder module and the embodied cellular phone having the data interface (I/F), which corresponds to the data interface (I/F) 215. Applications executed on the portable CE device, herein-embodied cellular phone, can 55 use the functionality of the RFID transponder module. An application program interface (API) layer may support the communication between applications and the RFID transponder module.

[0037] It shall be noted that the embodiment of the RFID transponder module shown in Fig. 2b illustrates one possible embodiment thereof. The depicted (logic and memory) units shall represent functional units. Those skilled in the art will appreciate on the basis of the description given above that the functional units may be composed in another way while still allowing the functionality of the identification module.

[0038] In principle, the inventive concept introduces conceptually enhanced RFID transponder with a detection functionality, which is embodied as detector logic 240 in Fig. 2b. In general, the detection functionality serves to survey the operation of the RFID transponder. That means that the detection functionality indicates on a detected event relating to operational states of the RFID transponder logic to the portable CE device, to which the RFID transponder is coupled. A (detection) event shall be understood as any event, on the detection of which the detector logic is dedicated and adapted to signalize. In more detail, the detector logic is dedicated to sense for example the reception of an interrogating signal received via the antenna or the energizing of the transponder logic in response to an activation via an interrogating signal but also to sense the reading-out of the transponder memory for generating a response signal and/or the emitting of the response signal in consequence on activation. In addition, the detector logic may sense attenuation or deactivation of the RFID transponder logic, effected subsequently to the emission of the response signal. Further detection events can be implemented.

[0039] The indication may be issued as an indication signal, which may be supplied directly to the coupled portable CE device 100 or which may be transmitted via the transponder control logic 210 to the coupled portable CE device 100. Fig. 2b illustrates a direct connection 310, which allows the detector logic 240 to issue a detection signal directly to the coupled portable CE device 100 and the processing unit thereof, respectively. Alternatively, the depicted data interface (I/F) 215 may be adapted for supplying the detection signal to the coupled portable CE device 100 and the central processing unit thereof, respectively. Correspondingly, an event detected by the detection logic 240 may firstly be signalized to the transponder control logic 210 and the transponder control logic 210 may subsequently indicate to the data interface (IF) 215 to issue the detection signal.

[0040] For instance, whenever the antenna 230 of the RFID transponder is exposed to an adequate electromagnetic (radio frequency) field, i.e. an interrogating radio frequency signal having predefined frequency/frequencies, the RFID transponder is activated. In case of a passive RFID transponder, the RFID transponder is energized by the interrogating radio frequency (RF) signal. The activation is detected by the detector logic as a corresponding detection event, which is signalized to the coupled portable CE device 100.

[0041] Fig. 2c shows a diagram of functional blocks,

on the basis of which a RFID module with transponder functionality and reader functionality is realizable. The schematically illustrated RFID module includes a RFID reader logic 211, which shall represent the RFID reader functionality, and a RFID transponder logic 212, which shall represent the RFID transponder functionality. Both functional logic units, i.e. the RFID reader logic 211 as well as the RFID transponder logic 212, require a radio frequency (RF) interface (I/F) 235 (and a high frequency

- 5 (HF) interface, respectively) and an antenna 230 adapted to the radio frequency (RF) deployed for operating. The embodiment illustrated in Fig. 2c purposes to use a common radio frequency (RF) interface (I/F) 235 and a common antenna 230 for utilization by both functional logic units. It shall be understood that the radio frequency (RF) interface (I/F) 235 as well as the antenna 230, which are presented in the present description according to embodiment of the invention, are adapted to employ any suitable radio frequency/frequencies used in the field of
- 10 20 RFID reader and transponders, respectively. In particular, at least typical operation frequencies aforementioned shall be realizable with the help of embodiments of the present invention.

[0042] In case of RFID reader functionality the antenna 230 is adapted to emit one or more interrogation signals and to receive one or more response signals for retrieving information from a RFID transponder.

[0043] In case of RFID transponder functionality the antenna 230 is adequate to receive one or more interrogation signals and to emit one or more response signals carrying information retrieved from the interrogated RFID transponder and transponder memory thereof, respectively.

[0044] The antenna 230 is connected to the radio frequency (RF) interface (I/F) 235 via one or more signal connections, which supply RF/HF signals generated by the radio frequency (RF) interface (I/F) 235 to the antenna 230 and which accepts RF/HF signals received by the antenna 230.

[0045] The radio frequency (RF) interface (I/F) 235 is responsible for both modulating and demodulating the signals to be transmitted and received by the antenna 230, respectively. Therefore, the radio frequency (RF) interface (I/F) 235 couples to the RFID reader logic 211 and the RFID transponder logic 212, respectively. In particular, the radio frequency (RF) interface (I/F) 235 receives from the RFID reader logic 211 signals to be modulated and transmitted and transmits demodulated signals to RFID reader logic 211. Additional, the radio frequency (RF) interface (I/F) 235 also transmits demodulated signals to the RFID transponder logic 211 and receives signals from the RFID transponder logic 211 to be modulated and transmitted. More particularly, the RF interface provides further signals necessary for the operation of the RFID transponder logic 211, which are in detail a power supply signal (voltage signal) and a clock signal. The power supply signal is gained from the coupling of the interrogating electromagnetic field, whereas

the clock signal is obtained from the demodulator comprised in the radio frequency (RF) interface (I/F) 235. The power supply signal and the clock signal may obligate for operating the RFID transponder logic 212, respectively, especially in case the illustrated RFID module shall simulate a passive RFID transponder energized by an interrogating signal of a RFID reader device.

[0046] The RFID module illustrated in Fig. 2c comprises moreover a switching logic 213, which is operated to switch between RFID reader functionality and RFID transponder functionality. The switching logic 213 is interposed between RFID reader logic 211, RFID transponder logic 212 and radio frequency (RF) interface (I/F) 235 and operated with a switching input for being supplied with a switching signal generated by the portable CE device 100. In detail, the switching logic 213 is operable to couple either the RFID reader logic 211 to the radio frequency (RF) interface (I/F) 235 or the RFID transponder logic 212 to the radio frequency (RF) interface (I/F) 235. Correspondingly in dependence on the switching state or position of the switching logic 213, RFID reader functionality or RFID transponder functionality is available.

[0047] The RFID module and hence the RFID reader logic 211 is provided with an interface indicated by communication connections 320 to allow an application, which is operated on the portable CE device for communication with the RFID module and in particular with RFID reader logic 211, respectively. The interface interfacing between RFID module and the portable CE device is established by appropriate hardware and software interfaces that allow access to the RFID module.

[0048] The implemented RFID reader logic 211 allows for RFID reader functionality as described above. Additionally, the RFID reader logic 211 may be adapted for RFID writer functionality. That means, a RFID reader with reader functionality is adapted to retrieve information stored in one or more RFID transponders. The reader functionality is at least the basic functionality of a RFID reader. A RFID reader with writer functionality is adapted to add information to RFID transponders to be stored therein and/or modify information stored in RFID transponders. It shall be noted that the adding and/or modifying of information stored in RFID transponders depends on the capability of the RFID transponders and/or authorization of the RFID reader. The writer functionality is an enhanced functionality of a RFID reader.

[0049] The RFID transponder functionality as described above may be employed to establish a communication mode, which shall be denoted as show communication mode. In the show communication mode the RFID transponder functionality is switched while the RFID reader functionality is switched-off, i.e. is out of operation. The show communication mode is distinguished from the known communication modes therein that the RFID transponder functionality provides the physical advantage of passive RFID transponders, which do not require any internal power supply. The illustrated

show communication mode primarily takes into account the requirement to provide for RFID transponder functionality even in case the RFID module is not energized by an external/internal power supply but energized by an interrogating signal, which can only serve for a limited power supply. This means, the RFID transponder functionality may be active by default in case the RFID module is powered down and the RFID module operates with the RFID reader functionality in case the RFID module is

5 powered up. In an embodiment of the invention, the portable CE device which comprises (internally or externally) the RFID module energizes the RFID module, in case the portable CE device is powered up (switched on). Consequently, in case the portable CE device is switched on, 10 the RFID reader functionality is active and in case the portable CE device is switched off, the RFID transponder functionality is active. Nevertheless, the switching logic allows changing the functionality between RFID reader functionality and RFID transponder functionality at any 15 time if required and in case the RFID module is energized.

[0050] The information stored in the RFID transponder module that can be retrieved by a RFID reader as illustrated above is stored in an adequate storage component such as a transponder memory (not illustrated). The storage component may be a read-only storage component or a configurable storage component. In case of a configurable storage component a number of storage technologies are applicable and in particular non-volatile configurable storage technologies are of interest.

[0051] The RFID module and hence the RFID transponder logic 212 may also be provided with an interface indicated by communication connections 300 to allow an application, which is operated on the portable CE device for supplying data to the RFID module and in particular to RFID transponder logic 212 having a transponder memory, respectively. The interface interfacing between RFID module and the portable CE device is established by appropriate hardware and software interfaces that allow access to the RFID module.

[0052] In analogy to Fig. 2b, it shall be assumed that the RFID module as embodied in Fig. 2c is attached to or embedded in a portable CE device 100. Conventionally, the RFID module may be provided with an interface such as a serial interface interfacing data exchanged between the RFID module and the portable CE device 100 such that applications executed on the portable CE device 100 can use the functionality, which is provided by the RFID module. An application program interface (API) layer may support the communication between applications operated on the portable CE device 100 and the RFID module.

[0053] As described above with reference to Fig. 2a and Fig. 2b, the detection functionality generally serves to survey the operation of the RFID transponder. With respect to Fig. 2c, the detection functionality serves to survey the operation of the RFID module and in particular the operation of the RFID module being operated with transponder functionality (i.e. transponder mode). That

means that the detection functionality indicates on a detected event relating to operational states of the RFID transponder logic 212 to the portable CE device 100, to which the RFID module is coupled. In analogy to the description above, a (detection) event shall be understood as any event, on the detection of which the detector logic is dedicated and adapted to signalize. In more detail, the detector logic 240 is dedicated to sense for example the reception of an interrogating signal received via the antenna or the energizing of the transponder logic in response to an activation via an interrogating signal but also to sense the reading-out of the transponder memory for generating a response signal and/or the emitting of the response signal in consequence on activation. Further detection events can be implemented.

[0054] In order to sense the reception of an interrogating signal received via the antenna or the energizing of the transponder logic in response to an activation via an interrogating signal, the detector logic 240 may be connected to the radio frequency (RF) interface (I/F) 235 or the antenna 230, upon which the reception of the interrogating signal or the energizing of the transponder logic is detectable. Alternatively, the detector logic 240 can be also coupled to the transponder logic for sensing those events and/or for sensing further events such as aforementioned.

[0055] The indication may be issued as an indication signal, which may be supplied directly to the coupled portable CE device 100 or which may be transmitted via the transponder logic 210 to the coupled portable CE device 100. Fig. 2b illustrates a direct connection 310, which allows the detector logic 240 to issue a detection signal directly to the coupled portable CE device 100 and the processing unit thereof, respectively. Alternatively, the data interface (I/F) (not shown) may be adapted for supplying the detection signal to the coupled portable CE device 100 and the central processing unit thereof, respectively. Correspondingly, a detected event of the detection logic 240 may firstly be signalized to the transponder logic 212 and the transponder logic 212 may subsequently indicate to the data interface (IF) to issue the detection signal.

[0056] For instance, whenever the antenna 230 of the RFID module is exposed to an adequate electromagnetic (radio frequency) field, i.e. an interrogating radio frequency signal having predefined frequency/frequencies, the RFID transponder is activated. In case of a passive communication mode, the RFID module is energized by the interrogating radio frequency (RF) signal. The activation is detected by the detector logic 240 as a corresponding detection event, which is signalized to the coupled portable CE device 100 via signal connection 310.

[0057] With reference to Fig. 3a and 3b, operational sequences according to embodiments of the present invention will be illustrated, which relate to the operation of a detector logic being provided in conjunction with a RFID module or transponder and portable CE device, being connected to the RFID module and transponder,

respectively. The operational sequences illustrated in Fig. 3a and 3b are operable with the embodiments shown in Fig. 2a to 2c.

[0058] More particularly, the inventive methodology according to the present invention provides for one or more operations of the portable CE device, which operations are operable in response to the signalized detection event issued by the detector logic. In principle, the operations to be operable in response to a detection event are operable within a current context in accordance with which the detection event has been detected. Two distinct ways for determining context information relating to the current context shall be discussed. The first way is based on context information resulting from the information, which is provided by the radio frequency identification (RFID) module and transponder, respectively, whereas the second way is based on context information acquired with the help of other context acquisition means for obtaining context information in order to define the current context.

[0059] For instance, two basic use cases shall be referred to, with the help of which the operational sequences are described in order to ease the understanding. In a first use case, the detector logic embodied as back-end logic of a RFID transponder is employed in conjunction with various RFID-based transaction application for providing input to the portable CE device for enhancing security and privacy aspects, which are for example essential in numerous RFID-based ticketing /payment applications. In a second use case, the detector logic embodied as back-end logic of a RFID transponder is employed in conjunction with RFID-based service applications. The detector logic serves for an input to the portable CE device for enhancing initiation and use of the service applications.

[0060] With reference to Fig. 3a, the detection event handling according to an embodiment of the present invention starts in an operation S400. That means the detector logic surveys the operation of the RFID transponder and RFID module, respectively, in order to detect a detection event such as defined above.

[0061] In an operation S410, the RFID transponder / module is arranged within the coverage area of for instance a RFID reader, which emits interrogating signals. Accordingly, the detector logic detects a detection event, for instance the reception of the emitted interrogating signal and activation in response to the reception of the interrogating signal, respectively.

[0062] In an operation S420, the RFID transponder or RFID module operates in accordance with its functionality and emits a radio frequency (RF) response signal in consequence of the activation/energizing of the RFID transponder and RFID module, respectively. The response signal carries data stored in the transponder memory and read-out therefrom for being emitted via the antenna.

[0063] In an operation S430, the portable CE device receives a detection signal originated from the detector

logic. The detection signal informs the portable CE device about the detection event, upon which it has been issued.

[0064] Conventionally, the portable CE device being equipped with the RFID module / transponder, i.e. the RFID module / transponder is attached to, included in, embedded in or coupled to the portable CE device (c.f. Fig. 2a to 2c), may have control over the data stored in the RFID module / transponder in case of a configurable transponder memory. However, once data is stored in the transponder memory, the portable CE device is no longer involved in the operation of the RFID module / transponder. Conveniently, the detection signal originated from the detector logic provided with the RFID module / transponder according to an embodiment of the present invention serves / supplies a detection signal informing about the activity of the RFID module /transponder.

[0065] In an operation S440, the portable CE device receives the detection signal, informing about the detection event, upon which the detection signal has been issued. Example events have been described above in detail; herein the detection signal indicates the reception of an interrogating signal by the RFID transponder/module. In knowledge about a detected event indicated by the detection signal, the portable CE device is capable to process and/or to react in accordance with predefined operations.

[0066] As aforementioned, the context, which defines the predefined operations to be processed in response to the received detection signal, is determined in accordance with the data stored in the transponder memory and transmitted by the RFID transponder / module. In particular, the type of data stored in the RFID transponder / module and the contents of the stored data serve as context information, respectively. The portable CE device maintains for example a database, a list etc comprising associations between types of data and corresponding predefined operations to be processed. In general, the type of data and the data, respectively, which is stored in the RFID module / transponder defines in an inherent way the context, i.e. serves as context information. This means, the database, the list etc maintained by the portable CE device comprises associations between defined contexts and corresponding predefined operations to be processed by the portable CE device in response to the detection signal.

[0067] In an operation S450, the detection event handling according to an embodiment of the present invention is finished.

[0068] In order to enlighten the above-described operational sequence referred to in Fig. 3a, example use cases shall be presented.

[0069] The RFID transponder / module shall be used for providing ticket or payment related information; i.e. information about an electronic ticket or information about any means of payment (credit card, cash card, etc). Such information is sensitive since personal information may be comprised thereof. Whereas the provision of the ticket or payment related information via the RFID

transponder / module is normally under control of the user of the RFID transponder / module, the user has to rely on external information about the reading-out of the provided information. In accordance with the external information the user can decide whether the provided information can be withdrawn or not. For privacy aspect, sensitive information shall only be provided as long as absolutely required. But the user cannot be sure that the external information is reliable. In accordance with the

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- inventive concept provided and the detection signal supplied to the portable CE device, the user may be informed about the reading-out of the ticket or payment related information, the provision of the ticket or payment related information is automatically withdrawn or the user can manually instruct to remove the provision of the information.

[0070] With reference to the example use case briefly illustrated, the predefined operations may be defined in conjunction with the configuration of the transponder 20 memory with data for provision thereby. This means, simultaneously to the configuration RFID transponder / module for providing ticket or payment related information, the subsequent withdrawal operation in response to the indication of the activation of the RFID transponder 25 / module by a RFID reader is defined.

[0071] Moreover, the portable CE device may initiate an application in response to the detection signal, for instance a communication application is started, which establishes a wireless data communication connection, 30 which could be used to check whether the information provided by the RFID transponder / module has been transmitted correctly. Such a wireless data communication connection may comprise a Bluetooth connection, a WLAN (wireless local area network) connection, an IRDA (infrared data association) connection etc.

[0072] With reference to Fig. 3b, the detection event handling according to an embodiment of the present invention starts in an operation S500. The following operations S510 to S530 correspond essentially to the operations S410 to S430 described above. That means the detector logic surveys the operation of the RFID transponder or RFID module in order to detect a detection event such as defined above. In contrast to the operational sequence illustrated with reference to Fig. 3a, the embodiment of the present operational sequence relates to the utilization of other or additional context acquisition means, which allow acquisition of context information, on the basis of which the current context is definable.

[0073] In an operation S510, the RFID transponder / module is arranged within the coverage area of for instance a RFID reader, which emits interrogating signals. Accordingly, the RFID transponder /module is energized and activated by the interrogating signal, respectively.

[0074] In an operation S520, the RFID transponder or 50 RFID module operates in accordance with its functionality and emits a radio frequency (RF) response signal in consequence of the activation or energizing of the RFID transponder and RFID module, respectively. The re-

sponse signal carries data stored in the transponder memory and read-out therefrom for being emitted via the antenna.

[0075] In an operation S530, the portable CE device receives a detection signal originated from the detector logic. The detection signal informs the portable CE device about the detection event, upon which is has been issued.

[0076] Herein, the detection signal originated from the detector logic provided with the RFID module /transponder according to an embodiment of the present invention serves / supplies a detection signal informing about for instance the attenuation of the RFID module /transponder, which is detected after completion of the emission and subsequent deactivation of the RFID module /transponder in accordance with the above operation S520.

[0077] The portable CE device receives the detection signal in response to a detected event, upon which the detection signal has been issued. In knowledge about the detected event indicated by the detection signal, the portable CE device is capable to process and/or to react in accordance with predefined operations.

[0078] In an operation S540, the portable terminal determines, in which context it is currently operated and in which context the detection signal is issued.

[0079] As described briefly above, the portable terminal may be in knowledge about the information and data currently stored in the RFID transponder / module, respectively. For instance, the stored information / data have been configured previously by the portable terminal. Correspondingly, the type of information is known. Correspondingly, the one or more subsequent operations (referred to in operation S550 below) can be defined, adapted and planned with respect to the known type of information. As aforementioned this means for example that sensitive information stored in the RFID transponder / module can be revoked immediately after retrieval thereof, the portable CE device may be switched on, switched off or switched into a defined operation mode, a user interface may be configured to provide a selection of operations to be manually initiated by the user of the portable CE device, etc. Alternatively, the portable CE device may be instructed to initiate as predefined application or to close a predefined application. The number of possible reactions onto the detection signal may be continued.

[0080] Further, the context in which the portable terminal is currently operated may be acquired in any other suitable way. In particular, the context may be determined or concluded from information provided and served by external entities. Such information which allows obtaining the operational context, on the basis of which the operation of the portable CE device is adaptable, shall be designated as context information, whereas the operation of the portable CE device based thereon is designated as context awareness. The acquisition and processing of contextual information is described in detail with reference to Fig. 4a and 4b.

[0081] In an operation S550, the portable CE device

is provided with several predefined operations for being performed subsequent to the reception of the detection logic. In order to select one or more appropriate predefined operations from the several predefined operations,

5 the portable CE device refers to the contextual information, on the basis of which a selection is operable. Afterwards, the selected operation(s) are subsequently performed. In analogy to the operation S440, the portable CE device maintains for example a database, a list etc comprising associations between defined contexts and corresponding predefined operations to be processed by the portable CE device in response to the detection signal.

[0082] In an operation S560, the detection event handling according to an embodiment of the present invention is finished.

[0083] Contextual information, context information or context-related information may be understood as any information, on the basis of which conclusions can be drawn about the actual context, in which the portable CE device is currently operated. This means, the contextual information is suitable for performing the above-described selection operation.

[0084] It shall be noted that two ways for determine an adequate context have been illustrated above. The one way to determine context is to check the context in which the RFID transponder /module operates. The other way to determine the context utilized other means for defining context from the environment in accordance with contextual information. As a result, the context may also be defined by a combination of the two illustrated ways of context determinations. For example, although the portable CE terminal has determined a current context such as movie theater, the selection of the proper action should be based on the RFID transponder / module contents. When for example providing a device address via the RFID transponder/module, setting the Bluetooth module to paging is preferred of over setting the terminal into silent mode, which may be preferred subsequently upon detecting that the RFID module / transponder comprises data relating to a movie ticket.

[0085] The acquisition and processing of contextual information will be described with respect to Fig. 4a and 4b, which illustrate schematically implementations concerning the portable CE device and implementations relating to external source entities serving the contextual information.

[0086] With reference to Fig. 4a, functional components and units, respectively, which are implemented in the portable CE device, are depicted comprising a context information acquisition means 600, an analysis means 610, and a selection means 620, the inter-cooperation of which allow to carry out the method context-related operation of the portable CE device as described in the operation S550. The context information acquisition means 600 shall represent several distinct means, which allow acquisition of suitable contextual information. In detail, the context information acquisition means

600 may be operable with the cellular interface 180 for cellular communications with a radio access network (N/W) 520, a low power radio frequency (LPRF) interface 602 such as the Bluetooth transceiver with a Bluetooth network (N/W) 500, a WLAN transceiver with a WLAN network (N/W) 510, the ultra wideband (UWB) transceiver and any other transceiver operable with IEEE 802.xx standards for wireless data communications with a corresponding network. Alternatively, the context information acquisition means 600 may be the RFID transponder or reader 603 as aforementioned or may be a sensor means such as the GPS module 601. It shall be noted that the enumeration of the context information acquisition means 600 presented above is not limiting, a portable CE device operable with the present invention may be coupled internally or externally to one or more of the means illustrated above and/or may be coupled internally or externally to one or more means, which are adapted for obtaining suitable contextual information.

[0087] The context information acquisition means 600 is operable to obtain contextual information. In detail, the environment may be scanned (repeatedly) for (externally provided) information being employable as context-related information, on the basis of which (automated) selection may be operated. Suitable context-related information comprises several content types of information, which contents relate to different original purposes. Suitable context-related information might comprise at least location information, location-related information, location-based information and dedicated information, respectively.

[0088] The scanning operation should be understood as a passive scanning operation and an active scanning operation, respectively. During passive scanning, a context information acquisition means is adapted, configured or provided to obtain the context-related information, the supplying of which is initiated by an external source. That means that the context information acquisition means may be configured to be ready-to-receive context-related information. During active scanning, a context information acquisition means is adapted, configured or provided to actively obtain the context-related information by for instance active transmitting of one or more signals (e.g. interrogation signals), upon which initiates the supplying of the context-related information is operable.

[0089] The location information and location-related information primarily code a geographical position or an indication of place of the user using the location service. The location-based information primarily codes information, which are obtained on the basis of a location information. Location information and location-related information may be obtained via a cellular network implementing location service and location-based services, respectively. Alternatively, location information relating to a position information can also be obtained from global positioning system (GPS) signals received by a global positioning system (GPS) module. Such position information allows identifying a certain location/position e.g. a movie

theater etc. The dedicated information shall be understood as information, which refer to predefined operations and which codes one or more instructions, in accordance with which the operations can be referenced.

- 5 **[0090]** The context information obtained by the context information acquisition means 600 is then supplied to the analysis means 610, which is adapted to analyze the obtained contextual information. The analyzing operation depends and is based on the contents of the contextual information, which is obtained before. As aforementioned, the contents of the contextual information can differ significantly such that provisions may have been taken to enable the analyzing operation.
- 10 **[0091]** Referring back, the dedicated information comprising one or more instructions for referencing predefined operations is analyzed to result in a decoding of the one or more instructions comprised. The location information, location-related information and location-based information are analyzed to result in an association information, by the means of which operations are identifiable. The identification of the corresponding operations may be obtained by comparing the association information with a data item comprised in the operations in question or may be obtained by comparing the association information with a corresponding supplementary association information assigned to the operations in question.
- 15 **[0092]** On the basis of the analysis results, one or more operations are to be selected from a plurality of predefined operations maintained by the portable CE device.
- 20 **[0093]** A selection means 620 is adapted to select one or more operations from the plurality of predefined operations stored by the portable CE device.

- 25 **[0093]** According to an embodiment of the invention, contextual information input from various acquisition means such as the aforementioned low power radio frequency (LPRF) interface 602, cellular interface 180, global positioning system (GPS) module 601 RFID transponder/reader 603 etc, which is received by a dedicated software or a dedicated logic comprising the analysis means 610 and the selection means 620 coupled to e.g. an association database 621 and a operation storage 622. The association database 621 includes associations of various contextual information inputs with operation indications or references. That means that the indication and references constitute an association between current contextual information supplied and one of the predefined operations stored. The constitution of the association is obtained by employing an adequate association algorithm. After making the association, the dedicated software or logic retrieves the selected operations associated with current contextual information for being performed.
- 30 **[0094]** The analysis means 620 and the selection means 630 may represent program code sections, each including program codes, which, when carried out by a corresponding processing means such as a processor, controller and the like, perform the corresponding operations. Moreover, the aforementioned means comprising

the analysis means 620 and the selection means 630 may represent one or more logic circuits, which are adapted to perform the corresponding operations.

Use Case

[0095] Finally, a complex use case shall further enlighten both described operational sequences according to embodiments of the present invention.

[0096] It should be assumed a use case relating to the purchase and utilization of a movie ticket. The user has a portable CE device in the form of a cellular terminal equipped with a RFID module as embodied above. Firstly, the user contacts a web site dedicated for selling electronic movie tickets, purchases an electronic ticket and a dedicated service application in the cellular terminal configures the memory of the RFID module. The ticket might have been purchased e.g. over the cellular network interface implemented in the cellular terminal. In response to the purchase of the electronic movie ticket the RFID module might include various contents, such as for example:

- Terminal identification information, which is set as "always on" meaning, i.e. default setting, that the RFID transponder / module provides e.g. a an address identifier or an alias address relating to a low power radio frequency (LPRF) interface comprised by the cellular terminal if no other instructions are set;
- 30-days bus ticket, which is set as "hidden" until detecting suitable environment/context (e.g. a bus-stop or entering into a bus); and
- this newly acquired electronic movie ticket.

[0097] It is getting late and the user decides to take a bus to ensure that he will get to the movie theater in time. He walks to nearby bus-stop and scans with the RFID module of the cellular terminal a RFID transponder provided at the bus-stop, which automatically provides a connection to bus-timetable service. Timetable service is downloaded and a suitable bus is just coming. Simultaneous to the operation of scanning the RFID transponder at the bus-stop, the context of the cellular terminal is changed to "bus-stop"; i.e. the information acquired in conjunction with the RFID transponder at the bus-stop serves as contextual information. When the suitable bus arrives, the user just holds the cellular terminal with RFID module close to ticket redemption machine, and the machine reads the bus-ticket information from the cellular terminal. (This operation might include first reading a RFID transponder from the ticket redemption machine to ensure that the current context is "bus", and only thereafter the bus-ticket information is available at the RFID module.)

[0098] The detection logic detects the RFID reading operation and decision is made that bus-ticket information is currently activate, so the cellular terminal instructs the RFID module to remove the bus-ticket information

from the RFID module. Afterwards, the terminal sets back to the aforementioned default setting to be readable, i.e. the address identifier or alias addresses information. This operation is preferably performed in accordance with the embodiment described with respect to Fig. 3a.

[0099] In the bus, the user speaks with another user sitting on close seat and they decide to play a multiplayer tennis game. The bus is crowded, so the easiest way to establish a short-range connection for playing the game

10 is to get the devices into close approximation and the other user reads-out the address identifier (or alias address information) from the RFID module by a corresponding RFID module implemented in a cellular terminal of the other user.

15 **[0100]** The detection logic detects the RFID reading operation and a decision is made that address identifier (or alias address information) is currently activate, so the cellular terminal instructs the low power radio frequency (LPRF) module (e.g. Bluetooth / WLAN interface) of the 20 cellular terminal to enter into page scanning mode, and the cellular terminals initiate rapidly a low power radio frequency (LPRF) connection. This operation is preferably performed in accordance with the embodiment described with respect to Fig. 3b.

25 **[0101]** After leaving the bus, the user enters the movie theater, and a local service providing low power radio frequency (LPRF) access point (e.g. a Bluetooth / WLAN access point) contacts the cellular terminal of the user and the cellular terminal uses that information as contextual information to set the current context to "movie theater", which results in making the electronic movie ticket information available. When user enters the theater hall, he redeems his electronic movie ticket by showing his cellular terminal to entrance gate, which validates the 30 electronic movie ticket and the detection logic provided with the RFID module of the cellular terminal signalizes that the electronic movie ticket information is redeemed, which is used by the mobile terminal to initiate the configuration of the cellular terminal into silent mode operation,

35 or to activate a movie theater application, which might provide further information relating to the available films or like. This operation is preferably performed in accordance with the embodiment described with respect to Fig. 3b.

40 **[0102]** Additionally, there is always a possibility that the ticket information was misread for some reason. This could be remedied at least partly if the cellular terminal has e.g. other short-range communication means, such as a low power radio frequency (LPRF) interface, which

45 could be used to initiate a short-range communication connection with the ticket redemption machine to ensure that the ticket information provided through the RFID module was correctly read-out. This could be implemented e.g. by the cellular terminal asking from the ticket redemption machine whether a particular customer number is validated. If not, then the cellular terminal could provide a sensible alert to the user to reinsert the information to the RFID reader of the ticket redemption ma-

chine. It should be noted that also other solutions might be used (e.g. a green light in the ticket redemption device when information has been correctly read-out).

[0103] Comprehensively, the inventive concept is based on the "back-coupling detection logic", which provides means for the logic of the RFID transponder and RFID module, respectively, to inform the coupled portable CE device and processing unit (CPU) thereof, respectively, that information stored in the RFID transponder / module is read-out. Afterwards the processing unit (CPU) could check the type of information which has been read or could check the actual context in which the information has been read out, and activates, initiates, opens, wakes up applications, functions or operations that are associated with the read-out information.

Claims

1. Radio frequency identification device (200) comprising at least a radio frequency interface (235) along with a controller logic (210), wherein said radio frequency interface (235) is adapted to receive a radio frequency interrogating signal, in response to which said controller logic (210) supplies data to said radio frequency interface (235) to transmit a radio frequency response signal carrying said data, wherein said radio frequency identification device (200) comprises additionally a detector logic (240) which is adapted to provide a detection signal (310) responsive to a detected event relating to an operation of the radio frequency identification device (200), characterized in that said detection signal (310) is provided to an electronic device (100) arranged with said radio frequency identification device (200) and enables the electronic device (100) to survey the operation of said radio frequency identification device (200). 35
2. Device according to claim 1, wherein said detected event comprises at least one out of a group of detection events including:
 - receiving of said interrogating signal by said radio frequency interface (235);
 - energizing said radio frequency identification device (200) in response to said receiving of said interrogating signal;
 - supplying of said data to said radio frequency interface (235) in response to said receiving of said interrogating signal;
 - transmitting said radio frequency response signal; and
 - deactivating said radio frequency identification device (200) subsequent to said transmitting of said radio frequency response signal.
3. Device according to claim 1 or claim 2, wherein said radio frequency identification device (200) is operable with radio frequency identification reader functionality and radio frequency identification transponder functionality. 5
4. Device according to claim 3, wherein said radio frequency identification device (200) is operable with radio frequency identification transponder functionality to emulate a radio frequency identification transponder. 10
5. Device according to anyone of the preceding claims, wherein said detector logic (240) is provided integrally to one of said radio frequency interface (235) and said controller logic (210) of said radio frequency identification device (200). 15
6. Device according to anyone of the preceding claims, wherein said radio frequency identification device (200) comprises a configurable data storage (220). 20
7. Method, comprising:
 - detecting (S410, S510) an event by a detector logic (240) of a radio frequency identification device (200), wherein said detected event relates to an operation of said radio frequency identification device (200) employed for transmitting data,
 - wherein said radio frequency identification device (200) comprises at least a radio frequency interface (235) along with a controller logic (210), wherein said radio frequency interface (235) is adapted to receive a radio frequency interrogating signal, in response to which said controller logic (210) supplies data to said radio frequency interface (235) to transmit a radio frequency response signal carrying said data;
 - issuing (S430, S540) a detection signal (310) by said detector logic (240) in response to said detection event;
 - receiving (S430, S540) said detection signal (310) by an electronic device (100) arranged with said radio frequency identification device (200); and
 - performing (S440, S550) at said electronic device (100) one or more operations in response to said receiving of said detection signal (310).
8. Method according to claim 7, comprising:
 - selecting said one or more operations from a plurality of operations on the basis of a current operational context, wherein one or more associations are provided, which associate several contexts with said plurality of operations.

9. Method according to claim 7 or claim 8, wherein said detected event comprises at least one out of a group of events including:

- receiving of an interrogating signal by a radio frequency interface (235);
- energizing said radio frequency identification device (200) in response to said receiving of said interrogating signal;
- supplying of said data to said radio frequency interface (235) in response to said receiving of said interrogating signal;
- transmitting said radio frequency response signal by said radio frequency identification device (200) via said radio frequency interface (235); and
- deactivating said radio frequency identification device (100) subsequent to said transmitting of said radio frequency response signal.

10. Method according to anyone of the claims 7 to 9, wherein said one or more operations are predefined and in particular, said one or more operations relate to service or applications operable with said electronic device (100).

11. Method according to anyone of the claims 8 to 10, further comprising:

- obtaining said current operational context from a type information about said data, which is transmitted by said radio frequency identification device, wherein in particular said type information relates to contents of said data.

12. Method according to anyone of the claims 8 to 11, comprising

- obtaining context information, on the basis of which said current operational context is definable.

13. Method according to claim 12, further comprising at least one of said operations:

- obtaining information from an external source entity, wherein said obtained information serves as said context information; and
- obtaining said information from said external source entity and analyzing said obtained information to obtain said context information.

14. Computer program product comprising program code sections for performing the method according to anyone of claims 7 to 13, when said computer program is run on a controller, processor-based device, a computer, a microprocessor based device, a terminal, a network device, a mobile terminal or a

mobile communication enabled terminal.

Patentansprüche

1. Funkfrequenzidentifikations-Vorrichtung (200) umfassend mindestens eine Funkfrequenzschnittstelle (235) zusammen mit einer Kontrollerlogik (210), wobei die Funkfrequenzschnittstelle (235) eingerichtet ist, um ein Funkfrequenz-Abfragesignal zu empfangen, wobei die Kontrollerlogik (210) in Reaktion darauf Daten an die Funkfrequenzschnittstelle (235) liefert, um ein Funkfrequenz-Antwortsignal zu übertragen, das die Daten trägt, wobei die Funkfrequenzidentifikations-Vorrichtung (200) zusätzlich eine Erfassungslogik (240) umfasst, welche eingerichtet ist, um ein Erfassungssignal (310) bereitzustellen, in Reaktion auf ein erfasstes Ereignis, das sich auf einen Betrieb der Funkfrequenzidentifikations-Vorrichtung (200) bezieht, **dadurch gekennzeichnet, dass** das Erfassungssignal (310) an eine elektronische Vorrichtung (100) bereitgestellt wird, die mit der Funkfrequenzidentifikations-Vorrichtung (200) eingerichtet ist, und der elektronischen Vorrichtung (100) ermöglicht, den Betrieb der Funkfrequenzidentifikations-Vorrichtung (200) zu überwachen.
2. Vorrichtung gemäß Anspruch 1, wobei das erfasste Ereignis mindestens eines aus einer Gruppe von Erfassungereignissen umfasst, einschließend:
 - Empfangen des Abfrage-Signals durch die Funkfrequenzschnittstelle (235);
 - Versorgen der Funkfrequenzidentifikations-Vorrichtung (200) mit Energie in Reaktion auf das Empfangen des Abfrage-Signals;
 - Liefern der Daten an die Funkfrequenzschnittstelle (235) in Reaktion auf das Empfangen des Abfrage-Signals;
 - Übertragen des Funkfrequenz-Antwortsignals; und
 - Deaktivieren der Funkfrequenzidentifikations-Vorrichtung (200) im Anschluss an das Übertragen des Funkfrequenz-Antwortsignals.
3. Vorrichtung gemäß Anspruch 1 oder Anspruch 2, wobei die Funkfrequenzidentifikations-Vorrichtung (200) mit Funkfrequenzidentifikations-Leserfunktion und Funkfrequenzidentifikations-Transponderfunktion betriebsfähig ist.
4. Vorrichtung gemäß Anspruch 3, wobei die Funkfrequenzidentifikations-Vorrichtung (200) mit Funkfrequenzidentifikations-Transponderfunktion betriebsfähig ist, um einen Funkfrequenzidentifikations-Transponder zu emulieren.

5. Vorrichtung gemäß einem der vorangegangenen Ansprüche, wobei die Erfassungslogik (240) integral an die Funkfrequenzschnittstelle (235) oder die Kontrollerlogik (210) der Funkfrequenzidentifikations-Vorrichtung (200) bereitgestellt ist. 5 das Empfangen des Abfrage-Signals;
 - Liefern der Daten an die Funkfrequenzschnittstelle (235) in Reaktion auf das Empfangen des Abfrage-Signals;
 - Übertragen des Funkfrequenz-Antwortsignals durch die Funkfrequenzidentifikations-Vorrichtung (200) über die Funkfrequenzschnittstelle (235); und
 - Deaktivieren der Funkfrequenzidentifikations-Vorrichtung (100) im Anschluss an das Übertragen des Funkfrequenz-Antwortsignals.
6. Vorrichtung gemäß einem der vorangegangenen Ansprüche, wobei die Funkfrequenzidentifikations-Vorrichtung (200) einen konfigurierbaren Datenspeicher (220) umfasst. 10
7. Verfahren, umfassend:
 - Erfassen (S410, S510) eines Ereignisses durch eine Erfassungslogik (240) einer Funkfrequenzidentifikations-Vorrichtung (200), wobei das erfasste Ereignis sich auf einen Betrieb der Funkfrequenzidentifikations-Vorrichtung (200) bezieht, eingesetzt zur Übertragung von Daten,
 - wobei die Funkfrequenzidentifikations-Vorrichtung (200) mindestens eine Funkfrequenzschnittstelle (235) zusammen mit einer Kontrollerlogik (210) umfasst, wobei die Funkfrequenzschnittstelle (235) eingerichtet ist, um ein Funkfrequenz-Abfragesignal zu empfangen, wobei die Kontrollerlogik (210) in Reaktion darauf Daten an die Funkfrequenzschnittstelle (235) liefert, um ein Funkfrequenz-Antwortsignal zu übertragen, das die Daten trägt;
 - Ausgeben (S430, S540) eines Erfassungssignals (310) durch die Erfassungslogik (240) in Reaktion auf das Erfassungereignis;
 - Empfangen (S430, S540) des Erfassungssignals (310) durch eine elektronische Vorrichtung (100), die mit der Funkfrequenzidentifikations-Vorrichtung (200) eingerichtet ist; und
 - Ausführen (S440, S550) von einem oder mehreren Vorgängen an der elektronischen Vorrichtung (100) in Reaktion auf das Empfangen des Erfassungssignals (310). 15
8. Verfahren gemäß Anspruch 7, umfassend:
 - Auswählen des einen oder der mehreren Vorgänge aus mehreren Vorgängen auf der Basis eines aktuellen Betriebskontextes, wobei eine oder mehrere Verknüpfungen bereitgestellt werden, welche verschiedene Kontexte mit den mehreren Vorgängen verknüpfen. 20
9. Verfahren gemäß Anspruch 7 oder Anspruch 8, wobei das erfasste Ereignis mindestens eines aus einer Gruppe von Ereignissen umfasst, einschließlich:
 - Empfangen eines Abfrage-Signals durch eine Funkfrequenzschnittstelle (235);
 - Versorgen der Funkfrequenzidentifikations-Vorrichtung (200) mit Energie in Reaktion auf 25
10. Verfahren gemäß einem der Ansprüche 7 bis 9, wobei der eine oder die mehreren Vorgänge vordefiniert sind und im Besonderen der eine oder die mehreren Vorgänge sich auf einen Dienst oder Anwendungen beziehen, die mit der elektronischen Vorrichtung (100) betriebsfähig sind. 30
11. Verfahren gemäß einem der Ansprüche 8 bis 10, ferner umfassend:
 - Erhalten des aktuellen Betriebskontextes aus einer Typeninformation über die Daten, welche durch die Funkfrequenzidentifikations-Vorrichtung übertragen wird, wobei im Besonderen die Typeninformation sich auf Inhalte der Daten bezieht. 35
12. Verfahren gemäß einem der Ansprüche 8 bis 11, umfassend
 - Erhalten von Kontextinformation, auf deren Basis der aktuelle Betriebskontext definierbar ist. 40
13. Verfahren gemäß Anspruch 12, ferner umfassend mindestens einen der Vorgänge:
 - Erhalten einer Information von einer externen Quelleneinheit, wobei die erhaltene Information als die Kontextinformation dient; und
 - Erhalten der Information von der externen Quelleneinheit und Analysieren der erhaltenen Information, um die Kontextinformation zu erhalten. 45
14. Computerprogrammprodukt umfassend Programmcodeabschnitte zum Ausführen des Verfahrens gemäß einem der Ansprüche 7 bis 13, wenn das Computerprogramm auf einem Kontroller, einer Prozessor-basierten Vorrichtung, einem Computer, einer Mikroprozessor-basierten Vorrichtung, einem Endgerät, einer Netzwerkvorrichtung, einem mobilen Endgerät oder einem mobilen kommunikationsfähigen Endgerät ausgeführt wird. 50
- 55

Revendications

1. Dispositif d'identification de fréquence radio (200) comportant au moins une interface de fréquence radio (235) équipée d'un contrôleur logique (210), dans lequel ladite interface de fréquence radio (235) est apte à recevoir un signal d'interrogation de fréquence radio, en réponse auquel ledit contrôleur logique (210) fournit des données à ladite interface de fréquence radio (235) afin de transmettre un signal de réponse de fréquence radio transportant lesdites données,
 dans lequel ledit dispositif d'identification de fréquence radio (200) comporte en outre un détecteur logique (240) qui est apte à fournir un signal de détection (310) en réponse à un événement détecté connexe à une opération du dispositif d'identification de fréquence radio (200),
caractérisé en ce que ledit signal de détection (310) est délivré à un dispositif électronique (100) agencé avec ledit dispositif d'identification de fréquence radio (200) et permet au dispositif électronique (100) de surveiller l'opération dudit dispositif d'identification de fréquence radio (200). 20
2. Dispositif selon la revendication 1, dans lequel ledit événement détecté comporte au moins un événement parmi un groupe d'événements de détection incluant les étapes consistant à:
 - recevoir ledit signal d'interrogation par le biais de ladite interface de fréquence radio (235) ;
 - exciter ledit dispositif d'identification de fréquence radio (200) en réponse à ladite réception dudit signal d'interrogation ;
 - fournir lesdites données à ladite interface de fréquence radio (235) en réponse à ladite réception dudit signal d'interrogation ;
 - transmettre ledit signal de réponse de fréquence radio ; et
 - désactiver ledit dispositif d'identification de fréquence radio (200) à la suite de ladite transmission dudit signal de réponse de fréquence radio. 30
3. Dispositif selon la revendication 1 ou 2, dans lequel ledit dispositif d'identification de fréquence radio (200) est exploitable avec une fonctionnalité de lecteur d'identification de fréquence radio et une fonctionnalité de transpondeur d'identification de fréquence radio. 50
4. Dispositif selon la revendication 3, dans lequel ledit dispositif d'identification de fréquence radio (200) est exploitable avec une fonctionnalité de transpondeur d'identification de fréquence radio pour émuler un transpondeur d'identification de fréquence radio.
5. Dispositif selon l'une quelconque des revendications 5
- précédentes, dans lequel ledit détecteur logique (240) est prévu intégralement dans l'un des éléments parmi ladite interface de fréquence radio (235) et ledit contrôleur logique (210) dudit dispositif d'identification de fréquence radio (200).
6. Dispositif selon l'une quelconque des revendications 10 précédentes, dans lequel ledit dispositif d'identification de fréquence radio (200) comporte un stockage de données configurable (220).
7. Procédé, comportant les étapes ci-dessous consistant à :
 - détecter (S410, S510) un événement par le biais d'un détecteur logique (240) d'un dispositif d'identification de fréquence radio (200), dans lequel ledit événement détecté se rapporte à une opération dudit dispositif d'identification de fréquence radio (200) employé pour la transmission de données,
 - dans lequel ledit dispositif d'identification de fréquence radio (200) comporte au moins une interface de fréquence radio (235) équipée d'un contrôleur logique (210), dans lequel ladite interface de fréquence radio (235) est apte à recevoir un signal d'interrogation de fréquence radio, en réponse auquel ledit contrôleur logique (210) fournit des données à ladite interface de fréquence radio (235) en vue de transmettre un signal de réponse de fréquence radio transportant lesdites données ;
 - émettre (S430, S540) un signal de détection (310) par le biais dudit détecteur logique (240) en réponse audit événement de détection ;
 - recevoir (S430, S540) ledit signal de détection (310) par le biais d'un dispositif électronique (100) agencé avec ledit dispositif d'identification de fréquence radio (200) ; et
 - mettre en oeuvre (S440, S550) au niveau dudit dispositif électronique (100) une ou plusieurs opérations en réponse à ladite réception dudit signal de détection (310). 35
8. Procédé selon la revendication 7, comportant l'étape ci-dessous consistant à :
 - sélectionner une ou plusieurs opérations à partir d'une pluralité d'opérations sur la base d'un contexte opérationnel en cours, où une ou plusieurs associations sont fournies, lesquelles associent de multiples contextes à ladite pluralité d'opérations. 50
9. Procédé selon la revendication 7 ou 8, dans lequel ledit événement détecté comporte au moins un événement parmi un groupe d'événements incluant les étapes consistant à:

- | | | |
|--|---------------|---|
| <ul style="list-style-type: none"> - recevoir un signal d'interrogation par le biais d'une interface de fréquence radio (235) ; - exciter ledit dispositif d'identification de fréquence radio (200) en réponse à ladite réception dudit signal d'interrogation ; - fournir lesdites données à ladite interface de fréquence radio (235) en réponse à ladite réception dudit signal d'interrogation ; - transmettre ledit signal de réponse de fréquence radio par le biais dudit dispositif d'identification de fréquence radio (200) via ladite interface de fréquence radio (235) ; et - désactiver ledit dispositif d'identification de fréquence radio (100) à la suite de ladite transmission dudit signal de réponse de fréquence radio. | 5
10
15 | <p>sitif à base de processeur, sur un ordinateur, sur un dispositif à base de microprocesseur, sur un terminal, sur un dispositif de réseau, sur un terminal mobile ou sur un terminal apte à fournir une communication mobile.</p> |
| 10. Procédé selon l'une quelconque des revendications 7 à 9, dans lequel ladite une ou lesdites plusieurs opérations sont prédéfinies, et en particulier, ladite une ou lesdites plusieurs opérations se rapporte(nt) à un service ou à des applications exploitables avec ledit dispositif électronique (100). | 20 | |
| 11. Procédé selon l'une quelconque des revendications 8 à 10, comportant en outre l'étape consistant à : | 25 | |
| <ul style="list-style-type: none"> - obtenir ledit contexte opérationnel en cours à partir d'une information « de type » se rapportant auxdites données, laquelle est transmise par ledit dispositif d'identification de fréquence radio, où, en particulier, ladite information « de type » porte sur des contenus desdites données. | 30 | |
| 12. Procédé selon l'une quelconque des revendications 8 à 11, comportant l'étape ci-dessous consistant à : | 35 | |
| <ul style="list-style-type: none"> - obtenir une information de contexte, sur la base de laquelle ledit contexte opérationnel en cours est définissable. | 40 | |
| 13. Procédé selon la revendication 12, comportant en outre au moins l'une desdites opérations consistant à : | 45 | |
| <ul style="list-style-type: none"> - obtenir une information en provenance d'une entité source externe, dans laquelle ladite information obtenue est utilisée en tant que ladite information de contexte ; et - obtenir ladite information de ladite entité source externe et analyser ladite information obtenue en vue d'obtenir ladite information de contexte. | 50 | |
| 14. Produit-programme informatique comportant des sections de code de programme pour mettre en oeuvre le procédé selon l'une quelconque des revendications 7 à 13, lorsque ledit programme informatique est exécuté sur un contrôleur, sur un dispo- | 55 | |

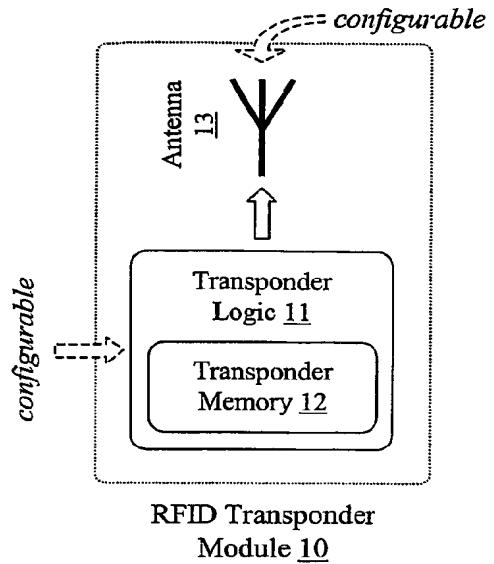


Fig. 1
State of the Art

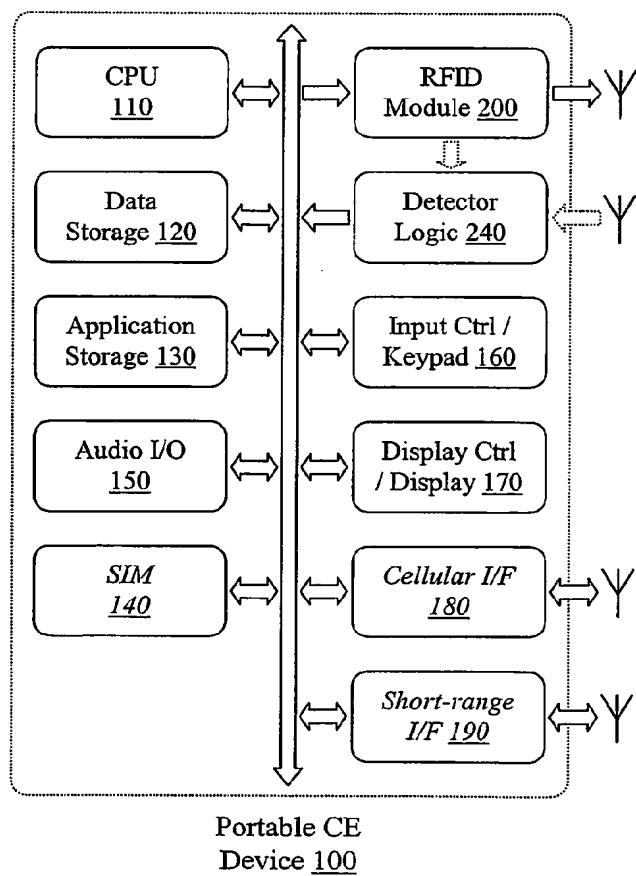


Fig. 2a

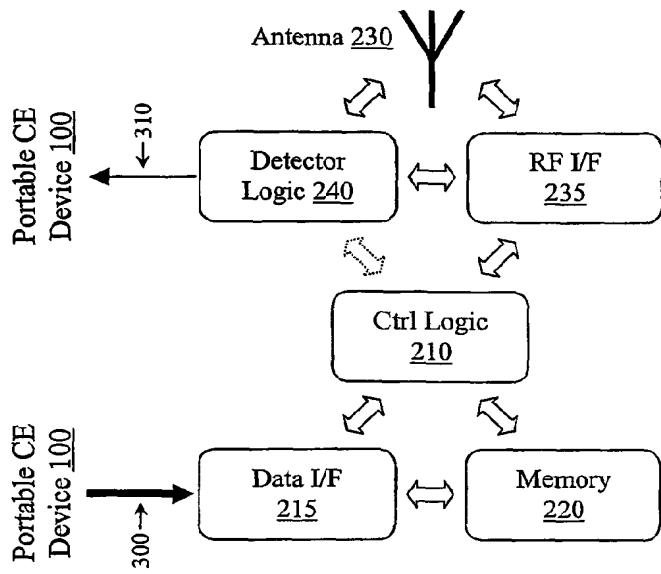


Fig. 2b

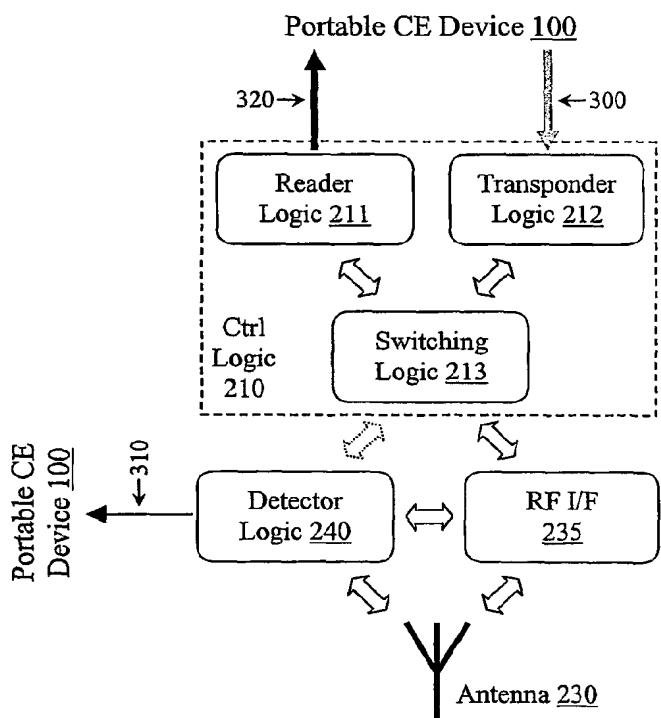


Fig. 2c

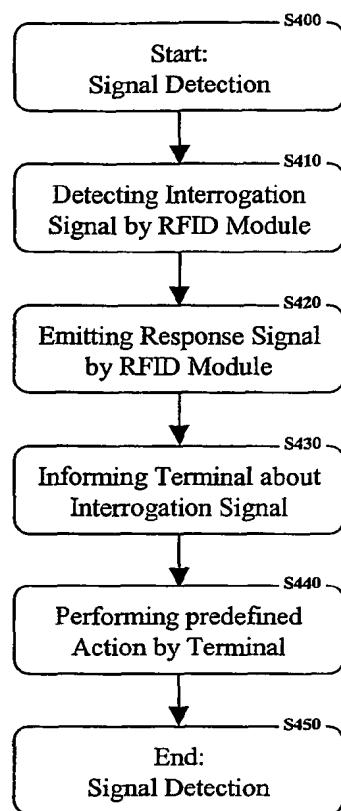


Fig. 3a

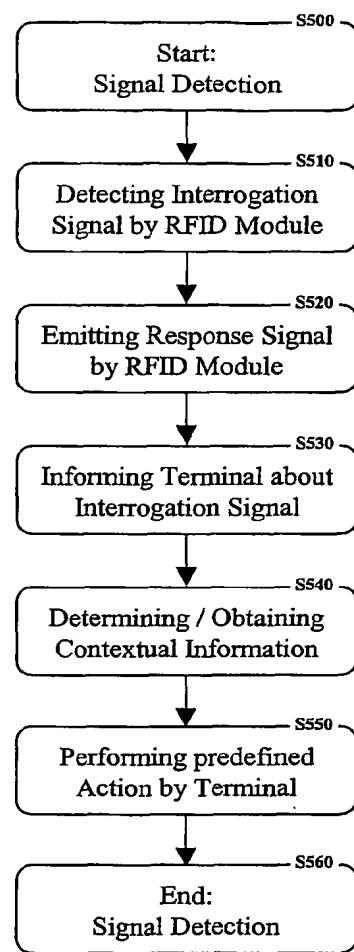


Fig. 3b

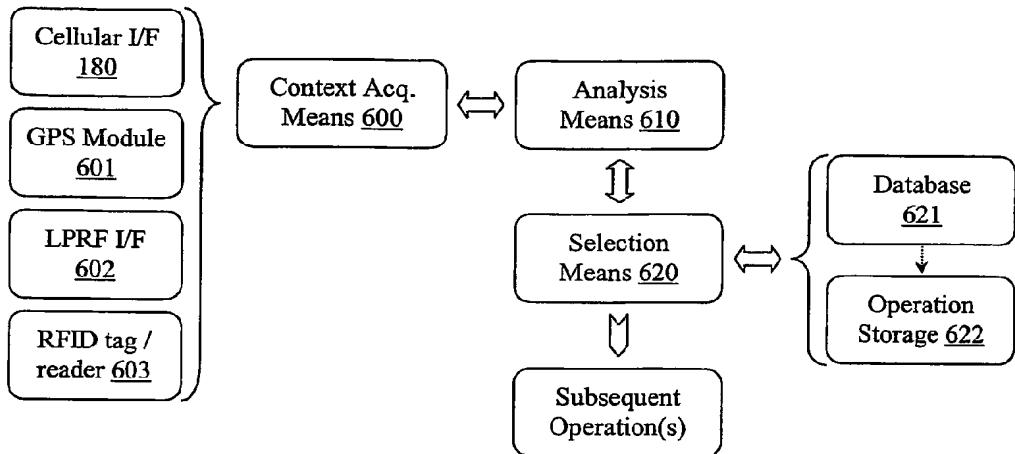


Fig. 4a

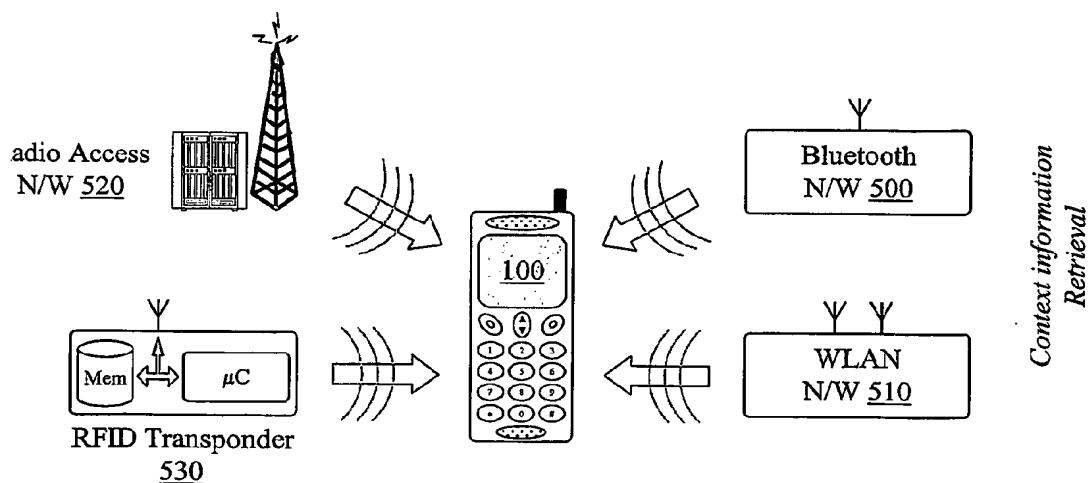


Fig. 4b

REFERENCES CITED IN THE DESCRIPTION

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